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ABSTRACT

A review of the research literature reveals that early in their school careers, children learn that reading is closely identified with the female role and, though less so, mathematics with the male role. These stereotypes increase with age and become particularly debilitating for females in math achievement. Though reading is strongly identified as "feminine," boys are apparently resiliant enough to overcome the stereotype. The identification of reading as feminine is not true universally and is more closely associated with North American countries. However, while sex differences in reading are common before age ten in the United States, they tend to disappear by adulthood. One possible explanation for this is that after elementary school, reading is no longer defined as a course but as a process, and becomes an essential tool in all school classes. An examination of studies that have analyzed sex differences in reading and math--after controlling for intelligence, reading readiness, spatial ability, and differential course taking--reveals that cultural and environmental factors are the primary explanations for such differences. (FL)

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# Cultural Factors and Sex Differences in Reading and Mathematics

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In little more than a decade sex differences have emerged as the significant variable studied in a large number of studies. These studies have investigated the conditions which underlie and precipitate sex differences in achievement. While there were some early studies which suggested cultural or environmental determiners for sex differences in reading and math, a large number of recent well-designed empirical studies of these differences and discrepant findings from cross-cultural research have added even more support for the part that sex role expectations have on achievement differences. While a number of American studies which have looked at sex role standards and achievement in reading and mathematics concurrently, most research on sex differences in these areas have looked at either one separately. However, the cultural factors which effect these areas are remarkably similar. It is the intent of this article to examine these recent studies of sex differences in achievement in reading and mathematics and examine the cultural factors related to these differences.

Achievement Studies

In the United States the National Assessment of Educational Progress testing program has provided the broadest picture on sex differences in achievement. In summarizing the results from the National Assessment of Educational Progress in Reading, Herman (1975) reported that at school age levels tested - 9, 13, and 17 year olds - girls read better than boys, but by adulthood sex differences were no longer significant. She attributed this trend

to the increasing need for men to read in job-related activities with reading being perceived as a tool appropriate for males as well as females.

Mullis (1975) reported the results of the National Assessment of Educational Progress in Math achievement at age levels 9, 13 and adulthood. Her report of the findings indicated that mathematics achievement was nearly equal at age nine between boys and girls. At the adult level there were large differences in the performance of males and females with males exceeding the performance of females. In a criticism of Mullis' report, Fennema and Sherman (1977a) pointed out that while males performed better than females at age 17 and adulthood, when educational and mathematical backgrounds were similar, males and females achieved similarly.

Well-controlled studies in both areas have generally found non-significant differences in reading and math. When factors such as I.Q. and readiness in reading were held constant, no significant differences were found in two early reading studies (Anderson, et. al., 1957; Balow, 1963). Early on researchers such as these and Gates (1961) suggested cultural explanations for sex differences in reading achievement.

Fennema and Sherman (1977b; 1978) conducted two large scale studies of sex differences in math achievement. While affective factors were highly related to achievement for females, no sex-related differences were found in verbal ability, spatial visualization and both lower and higher cognitive tasks. They attributed the discrepancy between these results and popular belief as due to

the confusion of comparing males and females of different mathematical backgrounds and ability.

Cross-cultural studies of achievement have been much more common in reading than in the math. The discrepancies found between cultures have lent much support to the cultural hypothesis. Johnson (1976) investigated sex differences in reading in four English speaking countries: United States, Canada, Nigeria and England. Boys read significantly better than girls in England and Nigeria. Girls generally made more significant gains in reading in the United States and Canada. Results indicated that differences could be attributed to cultural influences.

In an extensive review of reading achievement studies, Thompson (1975) found that trends in several English-speaking countries indicated a lower mean attainment in reading comprehension and vocabulary for boys than girls. However, the bulk of the evidence suggested no difference between the mean attainments of girls and boys over ten years old. This is supported by the National Assessment findings at age nine with differences diminishing with increased age.

The situation in Germany indicates that boys do at least as well as girls in reading, if not better (Preston, 1962). One cultural factor which might influence this finding is that in Germany a majority of elementary teachers are males. Despite this apparent equity in reading ability in German children, more boys still end up being referred to remedial classes for special help (Orlow, 1976). This tendency to refer more boys on the basis of personality factors versus actual need for remediation also occurs in the United States (Naiden, 1976).

Tests and Testing

It may be that some of the differences in achievement in reading and math can be accounted for by the nature of the tests themselves. Stein, Pohly and Mueller (1971) introduced three tests to sixth graders as either masculine, feminine or neutral in orientation. They found that girls scored equally well on feminine and neutral tests but significantly lower on the masculine test.

Christopolos and Borden (1978) investigated the effects of sex-stereotyped content on the verbal problem-solving scores of first graders. While total scores on sex stereotyped problems did not differ, girls performed significantly better on female oriented questions. These results indicated that the sex role orientation had an effect on the ability of the girls in the study.

Dwyer (1976) considered test content as a factor affecting sex differences in reading. Two issues were what type of test items were used to assess sex differences and the content specifications. She found that males achieved better on vocabulary than on comprehension tests with American males doing better on scientific content tests and females on verbal tests of the arts or humanities.

A similar finding occurred on the National Assessment of Educational Progress in Reading. Boys read better than girls generally on tests which dealt with male-oriented content concerned with reading signs, charts and forms (Herman, 1975). In the National Assessment of Mathematics, girls tended to outperform boys on pure computational items while males did better on word problems (Herman, 1975).

Sex Role Standards and Achievement

Fairly consistently in a number of studies, students perceive sex stereotypes related to reading and math. These stereotypes appear before sex differences in achievement occur, and effect later achievement in the case of math.

Sex typing of achievement areas emerges in elementary school and becomes even more pronounced in high school. Sheridan and Kaminski (1981) found children in grades two through six perceived girls as smarter in reading and boys as smarter in math. In a similar study with high school students, boys were perceived as doing better in math; and girls were perceived as doing better in English (Ernest, 1976).

Dwyer (1974) found that sex role standards for elementary and secondary school age students contribute significantly to the variance in scores in reading and math achievement, particularly for girls. These sex stereotyped perceptions increase with age and are stronger in reading than in math.

The stereotypes of reading and math as more appropriate for one sex or the other is related to the perception of these subjects as either masculine or feminine. Stein and Smithells (1969) measured the sex role standards about achievement among boys and girls in grades 2, 6, and 12. Students rated reading as feminine and arithmetic as masculine; the older the students the more extreme the ratings. Stein (1971) then investigated the sex role standards of six achievement areas. Again reading received consistent, though small feminine ratings; and math was the least sex-typed area although it was perceived as more masculine than feminine.

Downing and Thompson (1977) reported research findings on sex role stereotypes of three groups of subjects: university students, school-age children and a random sample of the adult population. Subjects significantly reported "girls" to a picture of a stick figure engaged in a reading activity. In a follow-up and extension of that study cross-culturally, Downing et. al (1979) found that boys in both Canada and the United States perceived reading as a feminine activity compared to boys in Denmark and Japan who consistently viewed it as masculine. Although boys in the U.S., Canada, England, Finland, and Israel begin by accepting reading as acceptable for males, they later switched and stereotyped it as a feminine activity confirming earlier studies which found that sex role stereotyping increased with age.

Cultural pressures encourage boys in mathematics and discourage girls in this area as sex role identification presents different cultural pressures with the child persisting on choices that he or she feel is appropriate. Because math is stereotyped as a male domain, girls perceive math achievement as incongruent with their feminine role (Burton, 1978).

The perception of mathematics as a male domain has a strong effect on female achievement in this area. Fennema and Sherman's studies found that at both the junior and senior high level math was rated as a male domain, with less female confidence in this area. They emphasized that the societal stereotyping of math as masculine resulted in females not achieving as well as they could if it were perceived as a neutral domain.

Similarly, Brush (1980) found that girls consistently perceived mathematics as much more difficult than did boys, felt they lacked the ability to do math, and had negative attitudes toward math. Girls also saw less usefulness of math for their future careers. Brush concluded that the social milieu discouraged girls from further study of mathematics because of its stereotype as masculine.

Stereotyping of math as a male domain is independent of preference for the subject at least in elementary school. Before grade six, there are little if any differences in attitudes towards math (Haladyna and Thomas, 1979). By grade nine differences become more pronounced with significantly poorer attitudes among females (Aiden, 1976; Norman, 1977). However, it is not the liking of math which is the factor that encourages boys to study math more than girls as it is the sex role expectations related to math achievement (Ernest, 1976).

Social Factors

There are a number of social factors which appear to affect achievement. Mokros and Koff's (1978) findings suggested that girls who are better readers are better liked than girls who are better mathematicians. Boys are better liked if they are more successful in math. Both boys and girls in their study agreed with the perception, and boys were more likely to believe boys would not like girls who did well in math.

Fox (1976) states that it is likely that in addition to the stereotyping of math as a male domain, there are other explanations which result in diminished achievement in math for females such as differential course taking, the lack of knowledge of the usefulness math in future educational and career plans, and the lack of support

of significant others. Other social factors include the absence of role models for women mathematicians and the presence of negative stereotypes for women and girls gifted in math.

When Luchins (1979) asked mathematicians at professional meetings to name outstanding women mathematicians, fewer women than men could do so. In another study she reported more women mathematicians recalling being discouraged in their studies by family and friends than did males. Women also reported more differential treatment as a math student and as a professional at all levels of training and employment. At every level of study of math, the attrition rate for women in math is higher than for men (Ernest, 1976).

Both teachers and parents expect girls to achieve less than boys, and this becomes a self-fulfilling prophesy. When elementary and high school teachers were asked who did better in English and math, of those teachers who perceived sex differences, 63% thought girls were better in English and 41% of the teachers reported boys in math. The remaining teachers reported no difference.

Although students report that mothers help more than fathers with homework in general, from grade six on, father becomes the expert in math and is consulted on that subject (Ernest, 1976). At both junior and senior high levels, girls report that their parents' attitude toward them is less positive in math achievement than boys. The effect of positive parent and teacher perception of girls in math achievement becomes significant at the high school level and these affective variables effect girls much more than boys (Fennema and Sherman, 1977b; 1978).

Conclusions

Fairly early in their school career, children learn that reading is more closely identified with the female role and, though less so, math with the male role. These stereotypes increase with age and become particularly debilitating for females in math achievement. Though reading is more strongly identified as "feminine," boys appear resiliant enough to overcome it.

The association of reading as feminine is not true universally and is more closely associated with North American countries. However sex differences in reading, while they are common before age ten in the United States, tend to disappear by adulthood. One possible explanation for this finding is that after elementary school "reading" is no longer defined as a course, but is a process which is not limited to particular course taking. Instead it is an essential tool in all school classes and as such is used daily both in and out of school.

When examining those studies which have looked at sex differences in reading and math - after controlling for factors such as intelligence, readiness, spatial ability and differential course taking - cultural and environmental factors emerge as the primary explanations for sex differences in reading and mathematics. These factors take on particular importance in the case of mathematics which is more dependent on direct instruction and specialized study. Biological factors alone are not great enough to account for the large number of qualified females who are capable of continuing study in mathematics, but choose not to. The gap in math ability appears during adolescence when strong sexual identity is developing

and the strong social pressures to conform to the perceived sex role handicaps girls in this area.

Ridding ourselves of the excess cultural baggage which unnecessarily effects children's achievement in reading and mathematics will enable us to help children achieve their potential not restricted by some prior notion of sex stereotypes unrelated to today's world.

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